Sabine-Neches Waterway Feasibility Study of Navigation Improvements

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Interagency Collaboration and Ecological Modeling for 48-Ft Project

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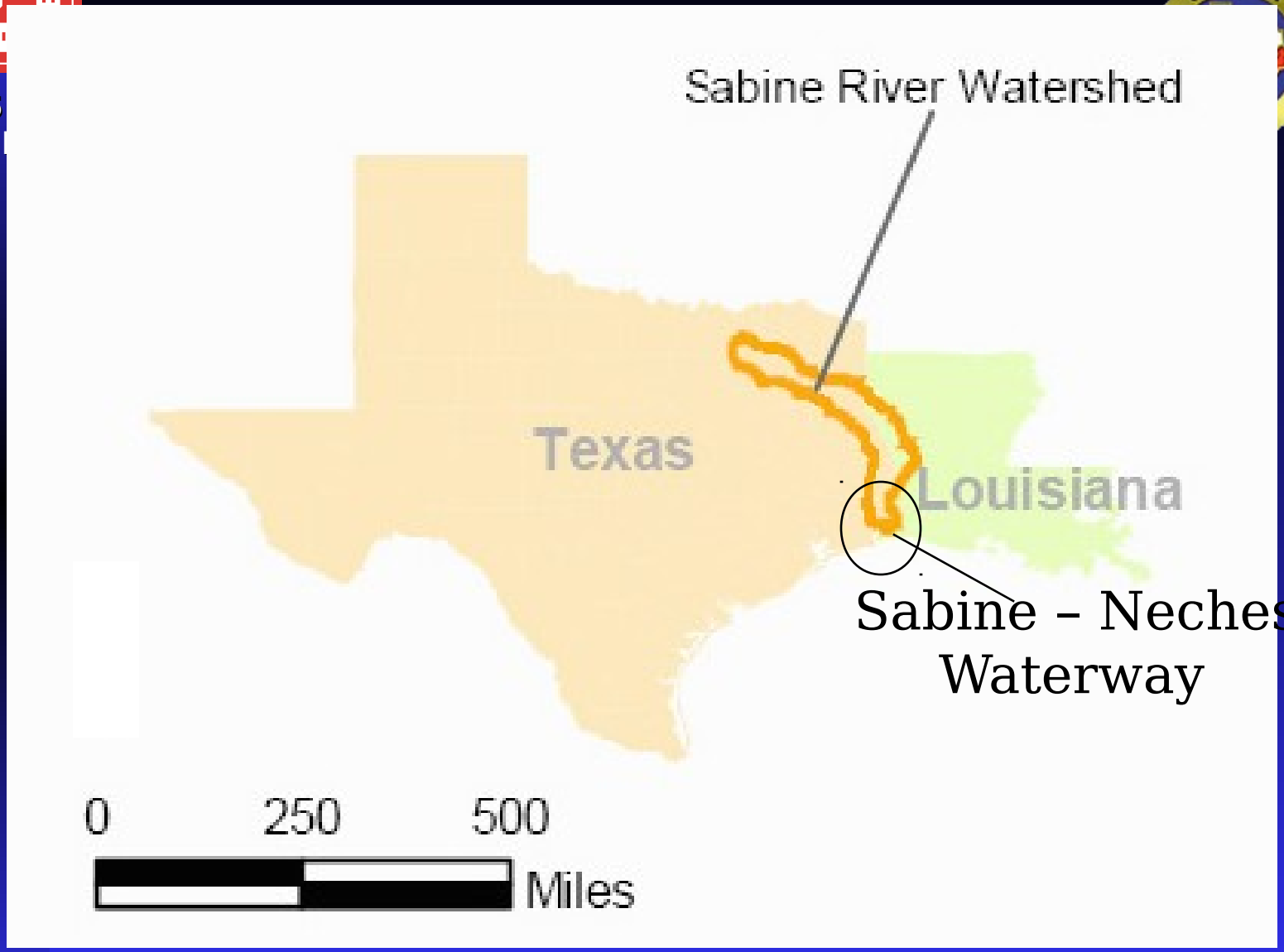
Sabine River Watershed
Texas
Louisiana
Sabine – Neches Waterway
0
250
500
Miles

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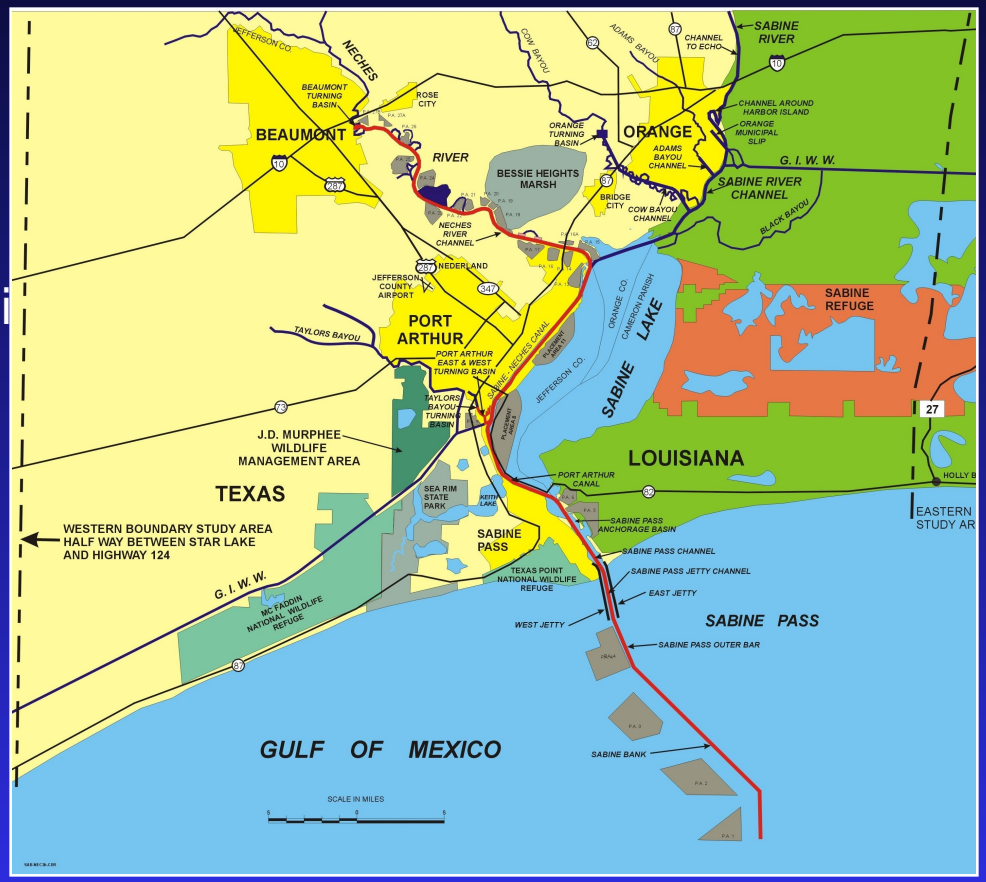
Existing Channel System

Entrance Channel – 22 mi Depth: 42’/ Width: 800’
Sabine Pass Channel – 5.6 mi Depth: 40’/ Width 500’

Port Arthur Canal – 6.2 mi Depth: 40’/ Width 500’

Sabine-Neches Canal – 11.3 mi
Depth: 40’/ Width 400’
Neches River Channel – 18 mi
Depth: 40’/ Width 400’



SNWW Feasibility Study Objectives

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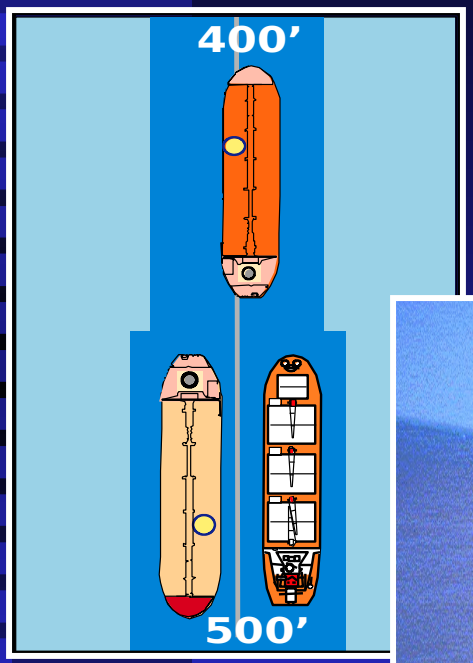

- Improve the navigational efficiency of the SNWW
- Improve safety along the waterway
- Maintain and/or enhance the coastal and estuarine resources

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Protected and Sensitive Habitats

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Primary Impact

Primary impact of deeper navigation channel is indirect adverse effect on coastal wetland habitats resulting from increased salinity and associated land loss

- **Salinity changes evaluate using a 3-D hydrodynamic - salinity estuarine model**
- **Ecological effects evaluat using Wetlands Value Assessment Model (WVA)**

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Interagency Coordination Team

- Galveston District, Corps of Engineers
- Jefferson County Waterway & Navigation District
- Environmental Protection Agency – Region XI
- U.S. Fish and Wildlife Service – TX and LA
- National Marine Fisheries Service - TX and LA
- Natural Resources Conservation Service
- Texas General Land Office
- Louisiana Department of Natural Resources
- Texas Commission on Environmental Quality
- Louisiana Department of Environmental Quality
- Texas Parks and Wildlife Department
- Louisiana Department of Wildlife and Fisheries
- Texas Water Development Board

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ICT Workgroups

- Hydrodynamic-Salinity (H-S) Modeling Workgroup
- Habitat Evaluation Workgroup
- Contaminants Workgroup
- Ocean Dredged Material Disposal Sites (ODMDS) Workgroup
- Restoration Workgroup

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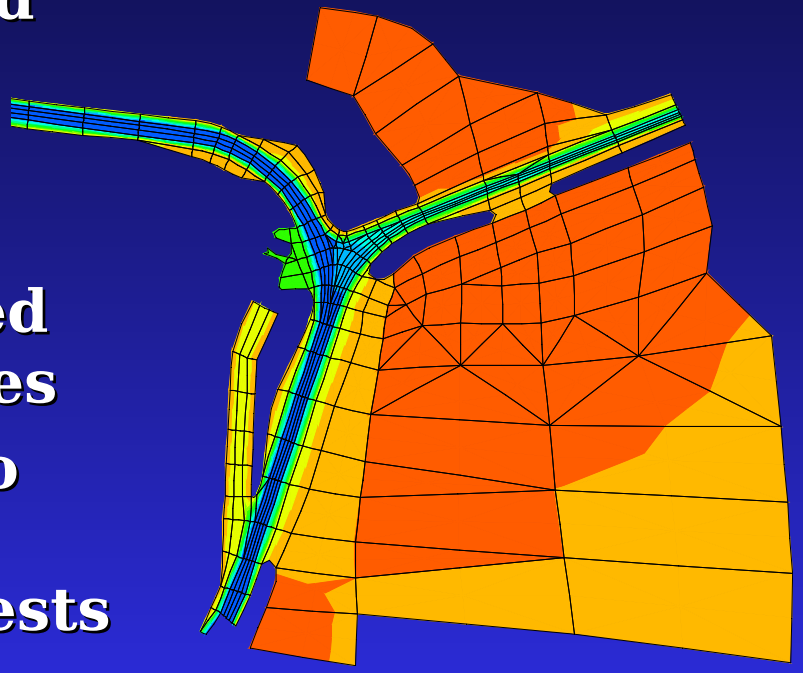
H-S Model

- 3-D salinity & circulation simulations of existing and future conditions
- Modeled 48 and 50-ft channel depths
- Median flow condition used to evaluate coastal marshes
- Low flow condition used to evaluate swamps & bottomland hardwood forests



H-S Modeling Workgroup

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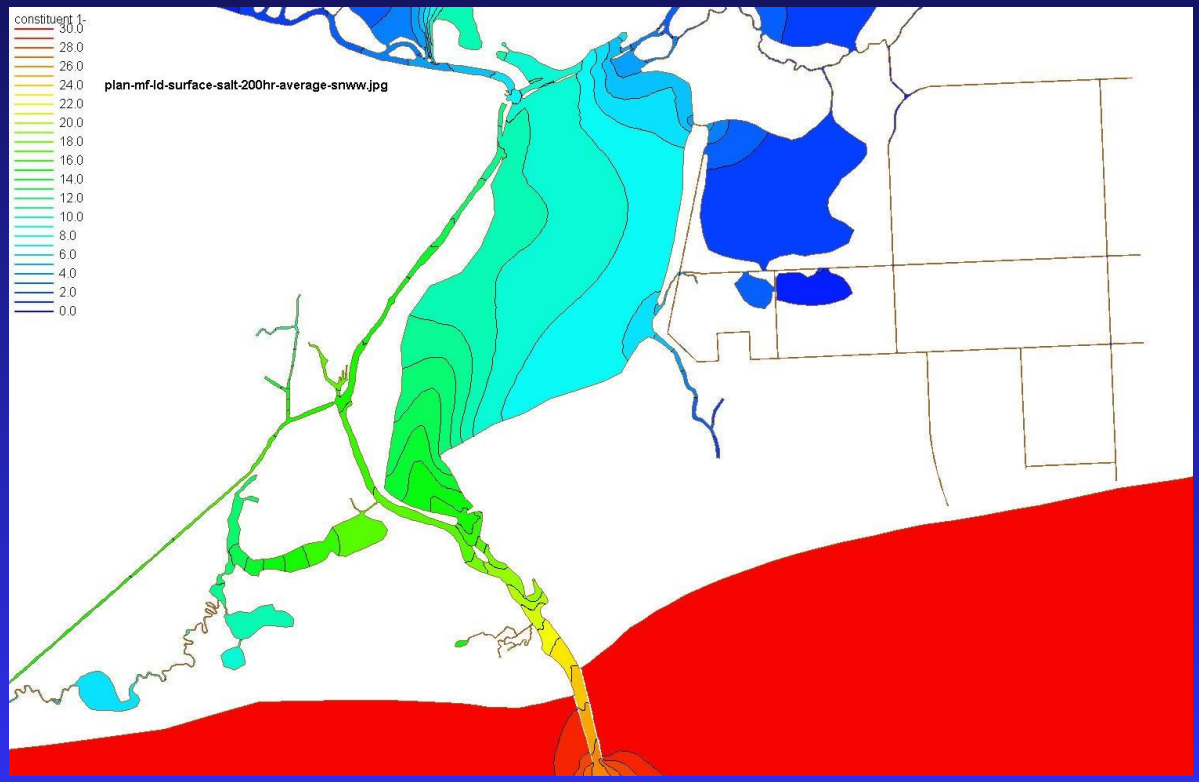
Sabine Lake Salinity with 48 Ft Project Median Flow

Assisted with:

- Data gathering
- Selecting FWP flow conditions
- Model Calibration & Verification



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Habitat Evaluation Workgroup

- Galveston District, Corps of Engineers
- US Fish & Wildlife Service (UFWS)- Ecological Field Offices Clear Lake (TX) & Lafayette (LA)
- USFWS – Chenier Plain National Wildlife Refuge (NWR)
- USFWS – Sabine NWR
- National Marine Fisheries Service (NMFS) TX & LA
- Environmental Protection Agency Region VI
- Texas Parks & Wildlife Department (TPWD) – Federal Projects Review
- TPWD – J. D. Murphree Wildlife Management Agency
- Louisiana Department of Natural Resources – Coastal Restoration Div
- Louisiana Department of Wildlife and Fisheries
- Sabine River Authority of Texas

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Wetlands Value Assessment Model

- Community model developed by CWPPRA Working Group
- Developed specifically for LA coastal wetland types which are also prevalent in the SNWW study area
- Chosen because variables are:
  - Sensitive to changes induced by SNWW project
  - Important in characterizing overall habitat quality
  - Easily estimated from existing data sources
- Accounts for quantity and quality of habitat changes over time in Average Annualized Habitat Units (AAHU)

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WVA Models Selected for SNWW Project

- Emergent Marsh Community Models
  - Fresh/Intermediate Marsh
  - Brackish Marsh
  - Saline Marsh
- Cypress-Tupelo Swamp Model
- Bottomland Hardwood Model

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Habitat Variables for Emergent Marsh Model

- V_1 - Emergent vegetation
- V_2 - Submerged aquatic vegetation
- V_3 - Marsh edge and interspersion
- V_4 - Water depth
- V_5 - Salinity
- V_6 - Estuarine organisı

  access

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Habitat Variables for Forested Wetlands Models

Cypress-Tupelo Swamp

- V_1 – Stand Structure
- V_2 – Stand Maturity
- V_3 – Water Regime
- V_4 – Mean High Salinity

Bottomland Hardwood

- V_1 – Species Association
- V_2 - Maturity
- V_3 – Understory & Midstory
- V_4 - Hydrology
- V_5 – Forest Size
- V_6 - Surrounding Land Use
- V_7 - Disturbance

WVA Model Components

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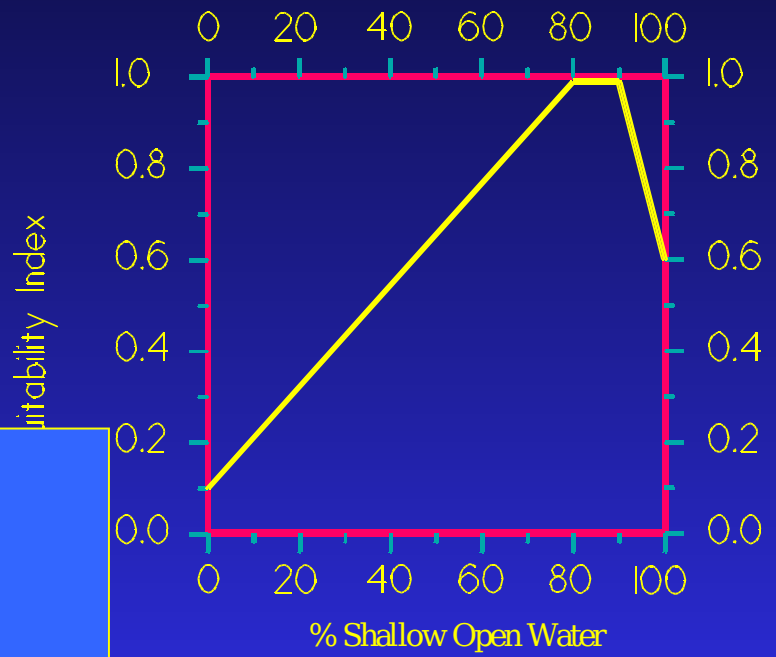
- Key habitat variables
- Suitability Index graphs
- Habitat Suitability Index



V4 Line Formulas

Fresh/intermediate marsh

If $0 \leq \% < 80$, then $SI = (0.01125 \times \%) + 0.1$

If $80 \leq \% \leq 90$, then $SI = 1.0$

If $\% > 90$, then $SI = (-0.04 \times \%) + 4.6$

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Habitat Suitability Index Formula

Brackish Marsh HSI

$$\frac{(3.5 \times (SIV_1{}^{5} \times SIV_6{}^{1.5})^{(1/6.5)}) + \frac{(SIV_3 + SIV_5)}{2}}{4.5}$$

Emergent Marsh HSI =

$$\frac{(3.5 \times (SIV_2{}^{3} \times SIV_6{}^{2})^{(1/5)}) + \frac{(SIV_3 + SIV_4 + SIV_5)}{3}}{4.5}$$

Open Water HSI =

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Habitat Unit

Numerical combination of habitat quantity (Acres) and habitat quality (Hab. Suit. Index - HSI)

Acres		HSI		HUs
500	x	0.8	=	400

Average Annualized Habitat Units (AAHU) = Total HUs averaged over 50-yr project life

WETLAND VALUE ASSESSMENT COMMUNITY MODEL

Brackish Marsh

Project: TX 8 Old River Cove Brackish Project Area: 8,760

Condition: Future Without Project

Variable		TY 0		TY 1		TY 51	
		Value	SI	Value	SI	Value	SI
V1	% Emergent	61.5	0.65	59.7	0.64	46.5	0.62
V2	% Aquatic	60	0.64	60	0.64	60	0.64
V3	Interspersion	%		%		%	
	Class 1		0.44		0.44		0.42
	Class 2	30		30		25	
	Class 3	60		60		60	
	Class 4	10		10		15	
	Class 5						
V4	%OW <= 1.5ft	60	0.87	60	0.87	55	0.81
V5	Salinity (ppt)	10	1.00	10	1.00	11	0.85
V6	Access Value	1.00	1.00	1.00	1.00	1.00	1.00
	Emergent Marsh HSI =		0.72	EM HSI =	0.71	EM HSI =	0.61
	Open Water HSI =		0.77	OW HSI =	0.77	OW HSI =	0.75

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Emergent Marsh WVA V_1- Percent Emergent Marsh

- **Establish hydrologic units**
- **Map habitat types within each hydrologic unit**
- **Land change projection method for V_1**
  - **FWOP land loss rate**
    - **GIS comparison of historic aerials from past 20-25 years**
    - **Calculate percentage loss of marsh per year**
    - **Project loss over 50 years**
  - **FWP land loss rate – Productivity Method**

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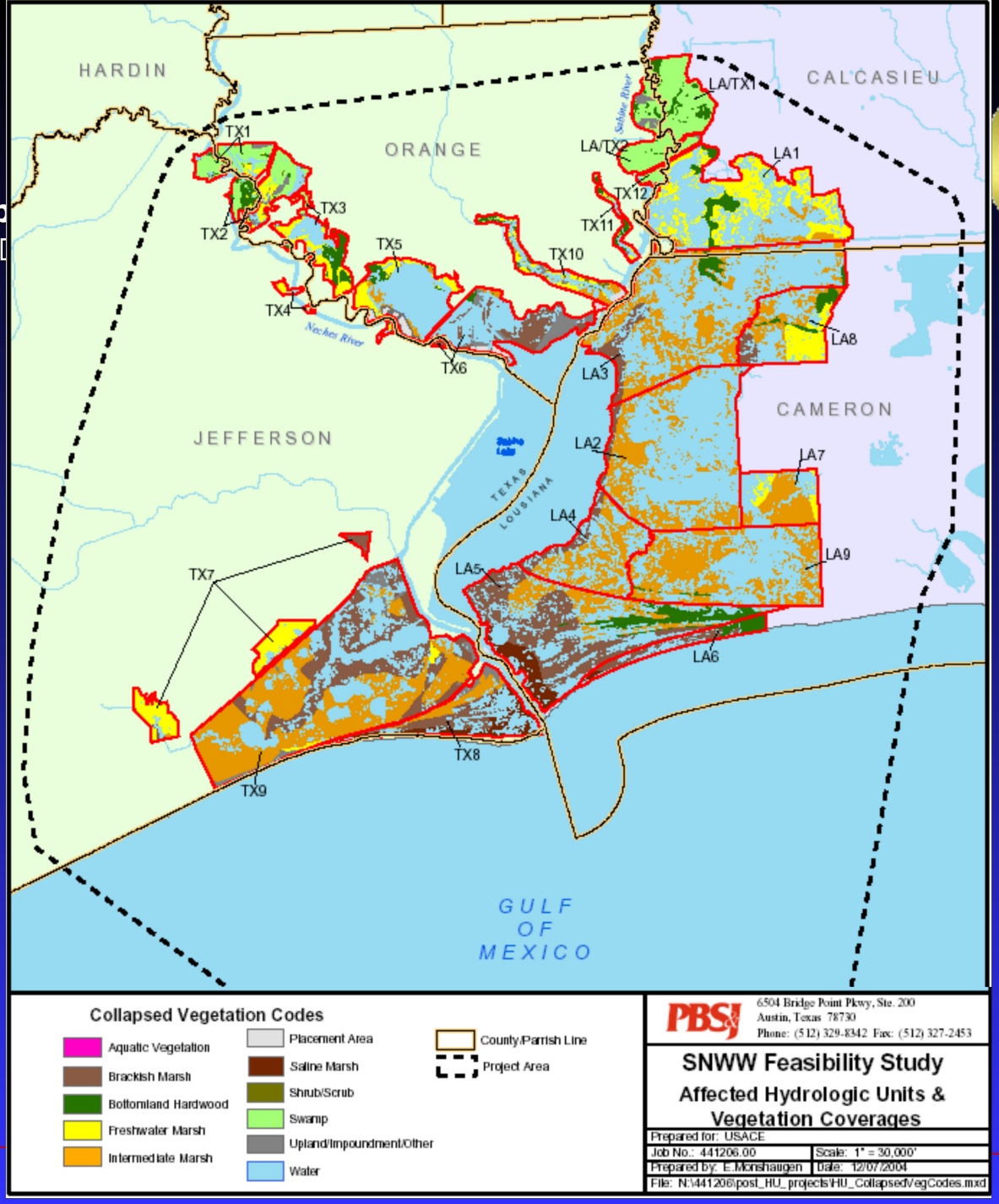

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FWP Land Loss Productivity Method

Habitat Type	Percent Land Loss Rates Increased per One ppt Increase in Salinity
Fresh marsh	11.10%
Intermediate Marsh	11.4% (*Sagittaria*), 2.3 % (*Spartina patens*); mean = 6.8%
Brackish	2.60%
Saline	2.10%

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Productivity Land Loss Formula

FWP land loss rate =

$(((Sal_{FWP} - Sal_{FWOP}) \times \%\ Pfactor_{Habitat}) + 1) \times Land\ Loss_{Baseline}$

Example

(((11 ppt-10 ppt) x .026) +1))) x .5 = .513

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Emergent Marsh Model Variables V_2 – V_6

Baseline Data Sources & FWOP Projections

- **V_2 - Submerged aquatic vegetation –** field inspection & expert professional judgment
- **V_3 - Marsh edge & interspersion –** comparison of aerial photos to standard model classes
- **V_4 - Water depth–** field inspection & expert professional judgment
- **V_5 – Salinity –** H-S model outputs
- **V_6 - Estuarine organism access -** identify extant & predicted structures & apply structure rating

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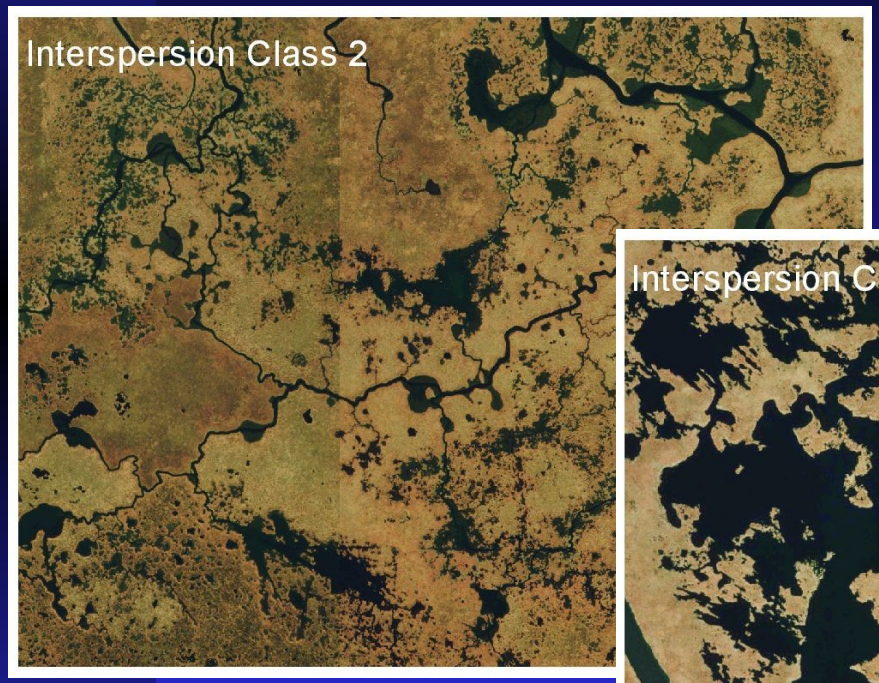
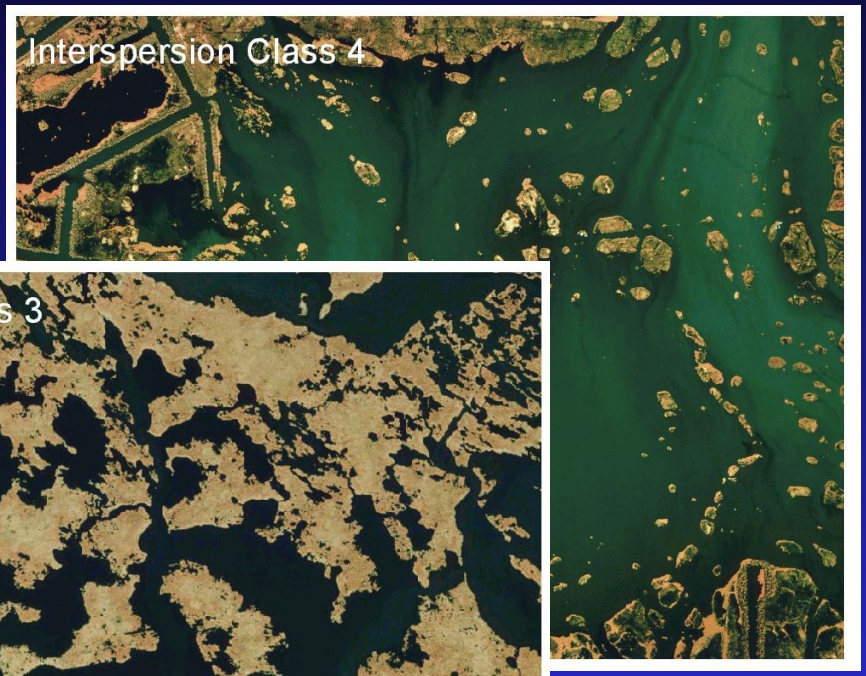
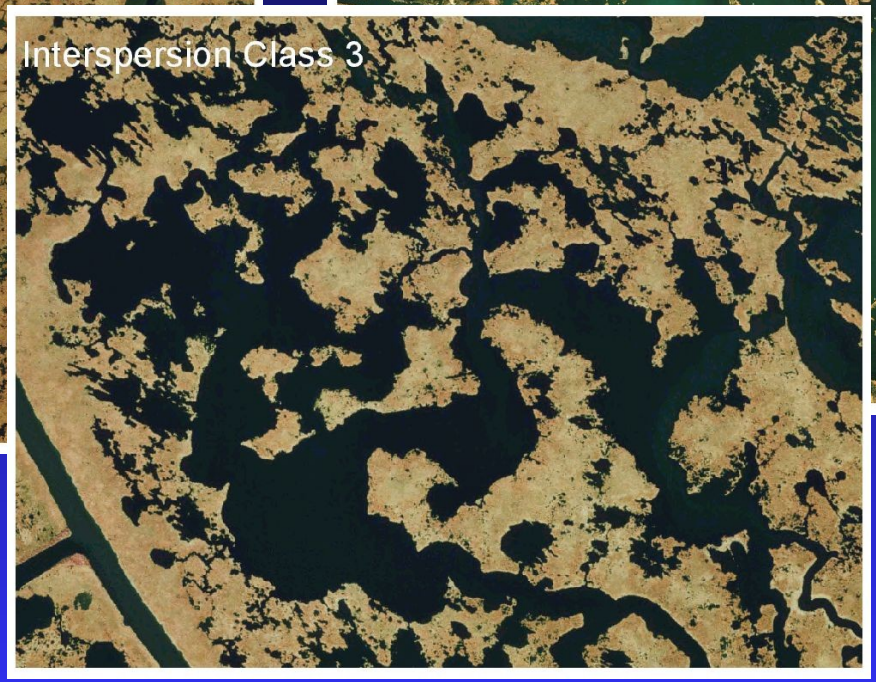
Emergent Marsh Model
V_3 Interspersion Class







Emergent Marsh Model
V_6 Partial Structure List

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Structure Type	Structure Rating
Open system	1
Rock weir set at 1ft BML , w/ boat bay	0.8
Rock weir with boat bay	0.6
Rock weir set at ≥ 1 ft BML	0.6
Slotted weir with boat bay	0.6
Open culverts	0.5
Weir with boat bay	0.5
Weir set at ≥ 1 ft BML	0.5
Slotted weir	0.4

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Emergent Marsh Model Variables V_2 – V_6

FWP or MFWP Projections

- **V2 - Submerged aquatic vegetation –** professional judgment of effect of salinity change
- **V3 - Marsh edge and interspersion –** change in class related to projected land loss
- **V4 - Water depth–** change related to projected land loss
- **V5 – Salinity –** H-S model or DOWSMM output
- **V6 - Estuarine organism access -** predictions of future structures

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WVA Strengths

- Community-based models better than species- based approach for large, multi-habitat study areas
- Measures changes in large-scale environmental parameters
- Can evolve with input of new information
- Easy to apply and understand
- Uses readily available GIS-based data for several variables
- Input for other variables can be based upon expert professional knowledge of study area
- AAHU's provide common currency

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WVA Weaknesses

- Model verification
- Only as good as the predictive tools that were used to provide variable values
- Complex habitat switching module

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Key Take-Away Points

- Identify ecological model early in study process
- Collaboration fosters understanding of necessary trade-offs and mitigation recommendations (buy-in)
- Involvement of natural resource agencies is critical to success

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Questions?